

Sterile Insect Controls for Soldier Fly Eradication

Objective

To develop and implement an integrated pest management (IPM) system in the Khaltina region that will reduce the population of soldier flies below the levels causing economic loss, eventually leading to local eradication of the soldier fly. The IPM system will incorporate a number of strategies, including release of F1 sterile males and parasitic wasps, as well as local pesticide applications, treatment of affected animals, and education and outreach to farmers and ranchers in the region.

Background

Increased production of primary agricultural commodities is important for both ensuring food security and developing export markets. Cattle ranching is a traditional way of life for people in the Khaltina region and is the mainstay of the agricultural economy for the region, as well as the major source of meat and leather products for markets throughout the country. The development of the ranching industry in Khaltina is hampered by economic losses as a result of endemic soldier fly infestation. In addition to the increased direct cost of raising cattle infested by the soldier fly, infestation results in costly export controls and inspections that limit the marketability of animal products from the region.

Sterile insect techniques are an accepted element of an IPM strategy, and have been successfully employed against the soldier fly in several neighboring countries. Sterile insect techniques help reduce the amount and frequency of pesticide applications required, limiting environmental damage from pesticides, preventing pesticide-resistant strains from developing, and lowering the overall costs of soldier fly control.

Institutional and Organizational Factors

With assistance from the World Bank and the IAEA, the Ministry of Agriculture initiated the IPM program in 1998. World Bank funding will support overall program planning and construction of insect breeding and irradiation facilities. Current IAEA Technical Cooperation assistance is providing training in nuclear source control and operation, as well as advanced training in insect breeding and sterilization. Facilities and personnel will be ready to receive and operate the gamma source needed for sterilization in early 2000.

A total of \$200,000 (US) Government funding has been approved for program activities and support facilities for the entomology service for 2000 – 2001. The veterinary medicine branch is also involved in program activities and is developing training materials for treatment and monitoring of soldier fly infestations in cattle, including protocols for region-wide animal health surveys.

The national Nuclear Commission is working in close cooperation with the Ministry of Agriculture to develop the sterile insect facility as part of the soldier fly eradication program. The Nuclear Commission

will retain custody of all nuclear materials, while the Ministry of Agriculture will provide overall program management and coordination.

On-Going Program Activities

Research on the biology, ecology, and biological control of the soldier fly is greatly assisted by information from IPM programs implemented in other countries over the last decade, but local conditions need to be more thoroughly assessed before field trials are begun. Fly population assessments are being implemented with monitoring of insect traps and a veterinary reporting system. Parasitic wasp species have been identified and are planned for release in affected areas, which will then be targeted for more intensive monitoring. These studies will provide information on the degree of isolation of local soldier fly populations and biological controls on their population that are necessary to determine the timing and number of sterile insect releases required.

Pesticide applications will also continue to be used to control large outbreaks of soldier fly, in conjunction with parasitic and sterile insect releases. Pesticide applications will be limited to localized areas so as limit damage to beneficial insect populations and prevent further development of pesticide resistance in the soldier fly.

The current program also includes animal treatment, rancher education, and agricultural extension services to control the soldier fly during the portion of its life-cycle within animal hosts. These activities are designed to encourage local farmers and ranchers to treat all affected livestock promptly, limit broad-spectrum pesticide applications, and report any outbreaks to the Ministry.

Technical Basis for Isotope Application

Successful soldier fly eradication programs are in progress in neighboring countries. Regional expertise is available from national centers there, greatly facilitating development of an IPM program for Khaltina. The use of gamma radiation to partially sterilize insects for field release in a delayed sterility program is well demonstrated. Soldier fly breeding techniques and dosimetry have been characterized and validated in large-scale field applications. Soldier fly populations are largely isolated within the Khaltina region by mountain ranges, providing an ideal field setting for a national IPM demonstration. The rapid breeding and short life cycle of the soldier fly also are well suited to sterile insect control.

Scope of Activities for the Proposed Project

The scope of activities proposed for 2000-2001 includes:

- Commissioning the captive breeding and insect irradiation facilities now under construction;
- Establishing healthy, disease-free production colonies of soldier flies and parasitic wasps on artificial diets;

- Installing and testing the radiation source, including dosimetry verification;
- Pilot-scale releases of sterile insects and parasitic insects to assess optimal timing and release ratios;
- Intensive monitoring of insect populations in the release areas;
- Continued education, outreach, training, and veterinary treatment, including surveys on animal health and pesticide usage; and
- Pesticide applications where other controls are not effective in limiting outbreaks.

Pilot-scale studies can be affected by adverse weather conditions in the release areas. Depending on successful completion of 2000 activities, in 2001 a regional release program will be implemented, together with increased monitoring throughout the region.

The proposed activities depend on support from the IAEA in the form of: 1) Equipment and radiation sources for sterilization of captive-bred fly populations; 2) Expert assistance on insect rearing and release technology, which can largely be accommodated through exchange with neighboring countries; 3) Training for local scientists, technicians and extension agents in IPM techniques, sterile insect and parasitic insect release and field assessment techniques, and economic and ecological studies in national workshops; and 4) Fellowships for in-depth training in IPM and sterile insect technology to develop a national IPM program based on results of the soldier fly eradication program.

Expected Results

The planned IPM program will reduce soldier fly populations in the target region, eventually leading to complete collapse of the population as the population density drops below the critical level required for survival. Under favorable conditions, including the continued success of eradication programs in neighboring countries, the soldier fly may be eliminated from the Khaltina area within two to three years, but continued monitoring and periodic treatment will be required to prevent re-infestation until eradication is complete region-wide. Other immediate results will include reduced pesticide applications, improved diagnosis and treatment of infested animals, and an improved agricultural extension service. Livestock herds are expected to grow and economic conditions to improve for local ranchers, although other factors, such as drought or lack of feed, may limit immediate improvements.

Follow-up and Application to Development Objectives

Soldier fly eradication will substantially improve the economic prospects for ranchers in the region by improving the productivity of their cattle as well as increasing the export opportunities for animal products. The IPM process demonstrated in this project will serve as a model for management of other insect pests in an economical sound and environmentally safe fashion. Decreased reliance on highly toxic pesticides through IPM also will improve the health and safety of farm workers without compromising the control of agricultural pests.